herein. The amendments the new claims have been made in a good faith effort to advance the prosecution on the merits. Please reconsider the claims pending in the application for reasons discussed below.

Claims 86, 87, 89, 90 and 96 stand rejected under 35 U.S.C. § 112, first paragraph. More specifically, the Examiner states that the specification enables a "ramping current" over time, but does not enable a "ramping voltage." The Examiner further notes that the specification discloses that the first bias voltage is constant, which is in conflict with claims 86, 87, 89, 90 and 96. In response, claims 86, 87, 89, 90 and 96 have been amended to more clearly recite aspects of the invention consistent with the specification. More specifically, "wherein the first biasing voltage increases over time" in claim 85 has been changed to "wherein the first biasing voltage is configured to generate a current that increases over time." (See specification, page 12, line 26 to page 13, line 2; page 13, line 23-26). "[R]amping voltage" in claims 86 and 96 has been replaced with "ramping current". (See specification, page 12, line 26 to page 13, line 2; page 13, line 23-26). "1 volt to about 5 volts" in claim 87 has been replaced with "about 0.8 volts". (See specification, page 12, line 1). "[W]herein the first biasing voltage is applied for about 0.125 second to about 1 second" in claim 89 has been replaced with "the first biasing voltage and the second biasing voltage are applied for about 0.25 seconds to about 5 seconds". (See specification, page 16, lines 1-15). Applicants believe that the amendments made therein overcome the § 112, first paragraph, rejection. Accordingly, claims 86, 87, 89, 90 and 96 are in condition for allowance.

Claims 85-92 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,203,684 (Taylor) in further in view of U.S. Patent No. 6,224,737 (Tsai).

Taylor generally is directed to a method for depositing a smooth layer of a metal onto a substrate. A modulated reversing electric current is passed through the plating bath having pulses that are cathodic with respect to the substrate and pulses that are anodic with respect to the substrate. The cathodic pulses have a short duty cycle and the anodic pulses have a long duty cycle. Taylor, however, does not teach, disclose or even suggest applying a first biasing voltage to the substrate while immersing the substrate into an electrolyte solution, wherein the first biasing voltage is configured to

generate a current that increases over time as the substrate is introduced into the electrolyte solution.

Tsai generally is directed to a method of forming a copper interconnect in an integrated circuit structure using a multiple step copper electroplating process that improves the throwing power, i.e., the ratio of growth rate in the trench to growth rate on the surface. This is accomplished by applying a "hot start" step, which includes applying a biasing voltage to the substrate before immersing the substrate into the electrodeposition solution to induce an electrical field proximate a trench bottom and sidewalls defined on the substrate surface. The substrate is then immersed or placed into the solution containing brighteners and levelers, and a plating voltage is applied to the substrate once the substrate is immersed. In this manner, the induced electrical field is configured to increase the concentration of brighteners proximate the trench bottom and the concentration of levelers proximate the trench sidewalls. Tsai, however, does not teach, disclose or even suggest applying a first biasing voltage to the substrate while immersing the substrate into an electrolyte solution, wherein the first biasing voltage is configured to generate a current that increases over time as the substrate is introduced into the electrolyte solution.

Neither Taylor nor Tsai, alone or in combination, teaches or discloses applying a first biasing voltage to the substrate while immersing the substrate into an electrolyte solution, wherein the first biasing voltage is configured to generate a current that increases over time as the substrate is introduced into the electrolyte solution. Furthermore, there is no suggestion discerned in Taylor or Tsai of modifying the devices or methods disclosed therein in the direction of the present invention, nor does there appear to be any suggestion of the desirability of such modifications. Therefore, claim 85 is patentable over Taylor in view of Tsai. Claims 86-92 are also patentable over Taylor in view of Tsai since they depend from claim 85.

Claims 93-97 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Accordingly, claims 93-97 have been rewritten in independent form, including the limitations of the base claim and any intervening claims.

With regard to new claims 98-101, Applicants submit that claims 98-101 recite subject matter that is neither disclosed, taught, nor otherwise suggested by the cited references, and as such, allowance of these claims is respectfully requested.

Claims 32-84 have been allowed.

In conclusion, the references cited by the Examiner, neither alone nor in combination, teach, show, or suggest the method or apparatus of the present invention. Having addressed all issues set out in the office action, Applicants respectfully submit that the claims are in condition for allowance and respectfully request that the claims be allowed.

The prior art made of record is noted. However, it is believed that the secondary references are no more pertinent to the Applicants' disclosure than the primary references cited in the office action. Therefore, it is believed that a detailed discussion of the secondary references is not deemed necessary for a full and complete response to this office action. Accordingly, allowance of the claims is respectfully requested.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

85. (Amended) A method of depositing a metal on a substrate having one or more features formed thereon, comprising:

applying a first biasing voltage to the substrate while immersing the substrate into an electrolyte solution contained in an electrolyte container comprising an anode immersed in the electrolyte solution], wherein the first biasing voltage is configured to generate a current that increases over time as the substrate is introduced into the electrolyte solution; and

applying a plating voltage to the substrate once the substrate has been immersed into the electrolyte solution[, the plating voltage being higher than the initial portion of the first biasing voltage].

86. (Amended) The method of claim 85, wherein the [first biasing voltage] current is a ramping [voltage] current.

87. (Amended) The method of claim 85, wherein the first biasing voltage [increases from about zero volt to a range of about 1 volt to about 5 volts] is about 0.8 volts.

88. (Amended) The method of claim 85, wherein the first biasing voltage is configured to limit etching by the electrolyte solution of a seed layer disposed on the one or more features formed on the substrate as the substrate is being immersed into the electrolyte solution.

89. (Amended) The method of claim [85] 94, wherein the first biasing voltage and the second biasing voltage [is] are applied for about [0.125] 0.25 seconds to about [1 second] 5 seconds.

90. (Amended) The method of claim 85, wherein the first biasing voltage [increases from about zero volt to a range of] ranges from about 1 volt to about 5 volts [in a period of about 0.125 second to about 1 second].

93. (Amended) [The method of claim 92,] A method of depositing a metal on a substrate having one or more features formed thereon, comprising:

applying a first biasing voltage to the substrate while immersing the substrate into an electrolyte solution contained in an electrolyte container comprising an anode immersed in the electrolyte solution, wherein the first biasing voltage is configured to generate a current that increases over time; and [wherein applying the pulsed biasing voltage comprises]

applying a positive plating current alternated with a negative de-plating current, the positive plating current being configured to cause deposition of metal inside the features, the negative de-plating current being configured to keep each opening of the features open while the metal is being deposited inside the features by the positive plating current.

94. (Amended) [The method of claim 85,] A method of depositing a metal on a substrate having one or more features formed thereon, comprising:

applying a first biasing voltage to the substrate while immersing the substrate into an electrolyte solution contained in an electrolyte container comprising an anode immersed in the electrolyte solution, wherein the first biasing voltage is configured to generate a current that increases over time; [further comprising]

applying a second biasing voltage to the substrate after applying the first biasing voltage [and prior to applying the plating voltage], the second biasing voltage being configured to attract metal ions contained in the electrolyte solution near the features; and

applying a plating voltage to the substrate once the substrate has been immersed into the electrolyte solution.

95. (Amended) [The method of claim 85,] A method of depositing a metal on a substrate having one or more features formed thereon, comprising:

applying a first biasing voltage to the substrate while immersing the substrate into an electrolyte solution contained in an electrolyte container comprising an anode

immersed in the electrolyte solution, wherein the first biasing voltage is configured to generate a current that increases over time;

applying a plating voltage to the substrate once the substrate has been immersed into the electrolyte solution; and

applying a second biasing voltage to the substrate after applying the first biasing voltage but prior to applying the plating voltage, wherein the second biasing voltage is configured to attract metal ions contained in the electrolyte solution near the features and wherein the second biasing voltage is higher than the plating voltage.

96. (Amended) [The method of claim 85,] A method of depositing a metal on a substrate having one or more features formed thereon, comprising:

applying a first biasing voltage to the substrate while immersing the substrate into an electrolyte solution contained in an electrolyte container comprising an anode immersed in the electrolyte solution, wherein the first biasing voltage is configured to generate a ramping current; and [wherein the first biasing voltage is a ramping voltage, and wherein applying the plating voltage step comprises]

applying a pulsed biasing voltage to the substrate once the substrate has been immersed into the electrolyte solution.

97. (Amended) [The method of claim 96,] A method of depositing a metal on a substrate having one or more features formed thereon, comprising:

applying a first biasing voltage to the substrate while immersing the substrate into an electrolyte solution contained in an electrolyte container comprising an anode immersed in the electrolyte solution, wherein the first biasing voltage is configured to generate a ramping current; and [wherein applying the pulsed biasing voltage comprises]

applying a positive plating current alternated with a negative de-plating current, the positive plating current being configured to cause deposition of metal inside the features, the negative de-plating current being configured to keep each opening of the features open while the metal is being deposited inside the features by the positive plating current.